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10/750,552	01/02/2004	Chen Ding	000687-00313	5538
27557	7590	04/17/2007	EXAMINER	
BLANK ROME LLP			RUTTEN, JAMES D	
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WASHINGTON, DC 20037			PAPER NUMBER	
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SHORTENED STATUTORY PERIOD OF RESPONSE		MAIL DATE	DELIVERY MODE	
3 MONTHS		04/17/2007	PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/750,552

Applicant(s)

DING ET AL.

Examiner

J. Derek Rutten

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 02 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-37 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 6/24/05.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

1. Claims 1-37 have been examined.

#### *Priority*

2. Applicant's claim for the benefit of a prior-filed application under 35 U.S.C. 119(e) or under 35 U.S.C. 120, 121, or 365(c) is acknowledged. Applicant has not complied with one or more conditions for receiving the benefit of an earlier filing date under 35 U.S.C. 119(e) as follows:

The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994).

The disclosure of the prior-filed application, Application No. 60/437,435 (hereinafter '435), fails to provide adequate support or enablement in the manner provided by the first paragraph of 35 U.S.C. 112 for one or more claims of this application. There is no disclosure in '435 regarding "affinity," "affinities," or "affinity groups." Accordingly, claims 11-17, 28-34, and 35-37 are not entitled to the benefit of the prior application.

### ***Drawings***

3. The drawings are objected to because they do not conform to the drawing requirements according to 37 CFR 1.84. Specifically, Figs. 1A-1D and 2A-2C contain text smaller than .32 cm (see 37 CFR 1.84(p)(3)). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

4. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the bounded error (claims 2-4 and 19-21), cut-off distance (claims 4 and 21), training inputs (claims 8 and 25), linear fitting (claims 10 and 27), predetermined quantity  $k$  (claims 11-14, 16, 28-31, 33, and 36), necessary conditions (claims 12-14 and 29-31), bins (claims 14 and 31), merging affinity groups (claims 15 and 32),

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comparing reuse signatures (claims 17, 34, and 37), and reference affinity (claims 17 and 34), must be shown or the features canceled from the claims. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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6. Claims 1, 5, 6, 18, 22, and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by “Reuse Distance Analysis” by Ding and Zhong (hereinafter “Ding”).

In regard to claim 1, Ding discloses:

*A method for analyzing reuse patterns of accesses of data by a program running on a computing device, the computing device having a memory in which the data are stored and from which the data are accessed* See paragraph 5 of section 1 on page 2, e.g. “method for measuring reuse distance”; Also paragraph 1 of section 1, e.g. “CPU and main memory”, *the method comprising:*

*(a) running the program on the computing device;* See paragraph 1 of section 2.3 on page 4, e.g. “At runtime...”

*(b) monitoring the accesses of the data by the program during step (a);* See paragraph 1 of section 2.3 on page 4, e.g. “...execution of these function calls provides a trace...” *and*

*(c) determining a reuse distance for each datum from among the data accessed by the program during step (a), the reuse distance being a number of distinct data which are accessed between two accesses of the datum.* See Figure 1 in view of paragraph 2 of section 2.2 on page 3, e.g. “reuse distance.”

In regard to claim 5, the above rejection of claim 1 is incorporated. Ding further discloses: *(d) determining a reuse pattern from the reuse distances determined in step (c).* See Figure 5 on page 7.

In regard to claim 6, the above rejection of claim 5 is incorporated. Ding further discloses: *wherein step (d) comprises forming a reuse distance histogram of the reuse distances by absolute ranges of the reuse distances.* See Figure 5.

In regard to claim 18, Ding discloses a computing device (see paragraph 1 of section 1 on page 2, e.g. "computing systems." All further limitations have been addressed in the above rejection of claim 1.

In regard to claims 22 and 23, the above rejection of claim 18 is incorporated. All further limitations have been addressed in the above rejection of claims 5 and 6, respectively.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 2, 3, 19, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding as applied to claims 1 and 18 above, and further in view of "Reuse Distance Analysis for Scientific Programs" by Zhong et al. (hereinafter "Zhong") in view of "The Relative Error of an Approximate Algorithm" by Bowen (hereinafter "Bowen").

In regard to claim 2, the above rejection of claim 1 is incorporated. Ding further discloses: *determining a last access time of each of the data*; See top of page 4; Ding does not expressly disclose: *organizing a search tree from the last accesses wherein the search tree comprises a node for each of the data, the node comprising the last access time and a weight of a sub-tree of the node; and compressing the search tree in accordance with a bounded relative error*. However, Zhong teaches storing traces of data accesses in a tree comprising access times and weights. See paragraph 3 in section 2.1 as appearing on page 3. Zhong also teaches compressing the tree in accordance with a bounded error using an approximation method. See paragraph 4 of section 2.1. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Zhong's compressed tree storage with Ding's trace in order to reduce space requirements as suggested by Zhong (see paragraph 1 of section 2.1). Zhong does not expressly disclose a *relative error*. However, Bowen teaches that relative error is a useful quantity for approximate algorithms. See page 1 paragraph 1. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Bowen's relative error with Zhong's approximation method in order to provide an indication of an optimal solution as suggested by Bowen (see last paragraph).

In regard to claim 3, the above rejection of claim 2 is incorporated. Ding does not expressly disclose: *wherein the search tree is compressed by (i) determining a capacity of each node in accordance with the reuse distance and the bounded relative error and (ii)*

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*merging adjacent ones of the nodes in accordance with the capacities of the nodes.*

However, Zhong teaches merging nodes. See section 2.1 paragraph 4. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Zhong's compressed tree storage with Ding's trace in order to reduce space requirements as suggested by Zhong (see paragraph 1 of section 2.1).

In regard to claims 19 and 20, the above rejection of claim 18 is incorporated. All further limitations have been addressed in the above rejection of claims 2 and 3, respectively.

9. Claims 4, 7-9, 21, and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding as applied to claims 1, 6, 18, and 23 above, and further in view of Zhong.

In regard to claim 4, the above rejection of claim 1 is incorporated. Ding further discloses: *wherein step (c) comprises: determining a last access time of each of the data;* See top of page 4; *maintaining a trace storing the last access times of the last C accesses of the data,* See section 2.2 on page 3. Ding does not expressly disclose: *where C is a cut-off distance; and maintaining a search tree storing access times other than the last C accesses, each node in the search tree having a capacity B, where B is a bounded absolute error.* However, Zhong teaches the use of precise and approximate traces stored as trees with nodes using cut-off distances that distinguish each trace. See section 2.1. Zhong further discloses a bounded absolute error. See paragraph 2 in section 2.1 on page

5. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Zhong's search tree with Ding's trace in order to reduce space requirements while maintaining an accurate trace for a bounded error as suggested by Zhong (see paragraph 2 of section 2.1).

In regard to claim 7, the above rejection of claim 6 is incorporated. Ding does not expressly disclose: *wherein step (d) further comprises forming a reference histogram of the reuse distances by percentile ranges of the reuse distances*. However, Zhong further discloses a histogram by percentile ranges. See Fig. 4 on page 9. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Zhong's percentile ranges with Ding's histogram in order to emphasize peaks where large portions of references occur, as suggested by Zhong (see paragraph 1 in section 3.2, page 8).

In regard to claim 8, the above rejection of claim 7 is incorporated. Ding does not expressly disclose: *wherein the reference histogram is formed for a plurality of training inputs*. However, this is taught by Zhong. See Fig. 4. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a plurality of inputs to show correlations between reuse distances and input sizes as suggested by Zhong (see Zhong, bottom of page 9).

In regard to claim 9, the above rejection of claim 8 is incorporated. Ding does not expressly disclose: *wherein step (d) further comprises using the reference histograms for the plurality of training inputs to map data size to the reuse distance*. However, this is taught by Zhong. See Fig. 4. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a plurality of inputs to show correlations between reuse distances and input sizes as suggested by Zhong (see Zhong, bottom of page 9).

In regard to claim 21 and 24-26, the above rejections of claims 18 and 23 are incorporated. All further limitations have been addressed in the above rejection of claim 4 and 7-9, respectively.

10. Claims 10 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding and Zhong as applied to claims 9 and 26 above, and further in view of "Linear Regression" by Yale (hereinafter "Yale").

In regard to claim 10, the above rejection of claim 9 is incorporated. Ding and Zhong do not expressly disclose: *wherein the data size is mapped to the reuse distance through linear fitting*. However, Yale teaches linear regression, which is the broad study of fitting a linear equation to observed data. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yale's teaching of

linear regression with Zhong's mapping in order to observe a relationship among data with a mathematical model, as suggested by Yale.

In regard to claim 27, the above rejection of claim 26 is incorporated. All further limitations have been addressed in the above rejection of claim 10.

11. Claims 11, 28, 35, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding as applied to claims 6 and 23 above, and further in view of U.S. Patent 5,349,656 to Kaneko et al. (hereinafter "Kaneko").

In regard to claim 11, the above rejection of claim 6 is incorporated. Ding does not expressly disclose: *(e) from the reuse distance histogram, forming an affinity group of at least two data which are always accessed within a distance k of one another, wherein k is a predetermined quantity.* However, Kaneko teaches affinity groups for data that is accessed within a certain distance. See column 10 lines 2-10. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Kaneko's affinity groups with Ding's histogram in order to improve the efficiency of a buffer storage unit as suggested by Kaneko (see column 10 lines 11-14).

In regard to claim 28, the above rejection of claim 23 is incorporated. All further limitations have been addressed in the above rejection of claim 11.

In regard to claims 35 and 36, Ding discloses a method for analyzing reuse distance. See paragraph 5 of section 1 on page 2. All further limitations have been addressed in the above rejection of claims 1 and 11.

12. Claims 12-16 and 29-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding and Kaneko as applied to claims 11 and 28 above, and further in view of U.S. Patent 6,421,668 to Yakhini et al. (hereinafter "Yakhini").

In regard to claim 12, the above rejection of claim 11 is incorporated. Ding does not expressly disclose: *wherein step (e) comprises selecting the data in the affinity group such that the data in the affinity group have average reuse distances which fulfill a necessary condition with respect to k*. However, Kaneko teaches that the affinity group is selected based upon a necessary condition that distance is short (see column 10 lines 3-7). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Kaneko's necessary condition in order to improve the efficiency of a buffer storage unit as suggested by Kaneko (see column 10 lines 11-14). Ding and Kaneko does not expressly disclose: *average*. However, Yakhini teaches average affinity. See column 20 lines 3-25. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yakhini's teaching of average affinity with Ding's reuse distance in order to provide an optimal partitioning of data as suggested by Yakhini (see column 2 lines 9-14).

In regard to claim 14, the above rejection of claim 12 is incorporated. Ding further discloses: *the reuse distance histogram comprises B bins*; See Figure 5. Ding and Kaneko do not expressly disclose: *and the necessary condition is that differences between the average reuse distances, summed over all of the bins, do not exceed kB*. However, Yakhini teaches that average affinities for a group of entities can be used to ensure that affinity does not fall below a threshold. See column 20 lines 3-25. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yakhini's teaching of affinity difference with Kaneko's affinity groups in order to provide an optimal partitioning of data as suggested by Yakhini (see column 2 lines 9-14).

In regard to claim 15, the above rejection of claim 14 is incorporated. Ding and Kaneko do not expressly disclose: *wherein step (e) comprises: (i) initially treating each of the data as an affinity group; (ii) traversing all of the affinity groups and merging any two affinity groups for which the necessary condition is met; and (iii) performing step (e)(ii) until no more of the affinity groups can be merged*. However, Yakhini teaches that entities are merged with an affinity group when a high affinity value is indicated, according to a necessary condition until all groups are formed (see column 19 lines 5-23). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yakhini's merging with Kaneko's affinity groups in order to provide an optimal partitioning of data as suggested by Yakhini (see column 2 lines 9-14).

In regard to claim 13, the above rejection of claim 15 is incorporated. Ding does not expressly disclose: *wherein the necessary condition is that the average reuse distances differ by no more than  $k$* . However, Yakhini teaches that average affinities for a group of entities can be used to ensure that affinity does not fall below a threshold. See column 20 lines 3-25. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yakhini's teaching of affinity difference with Kaneko's affinity groups in order to provide an optimal partitioning of data as suggested by Yakhini (see column 2 lines 9-14).

In regard to claim 16, the above rejection of claim 11 is incorporated. Ding and Kaneko does not expressly disclose: *wherein step (e) is performed a plurality of times for different values of  $k$* . However, Yakhini uses a set of variable parameters in order to adjust affinity groups. See column 13 lines 56-61. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yakhini's variable parameters with Kaneko's affinity groups in order to provide different clustering as suggested by Yakhini (see column 13 lines 21-23).

In regard to claims 29-33, the above rejection of claim 28 is incorporated. All further limitations have been addressed in the above rejection of claims 12-16, respectively.

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13. Claims 17 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ding as applied to claims 1 and 18 above, and further in view of Zhong and Yakhini.

In regard to claim 17, the above rejection of claim 1 is incorporated. Ding does not expressly disclose: *comparing reuse signatures of the data to determine whether two or more of the data have reuse signatures which differ by less than a predetermined percentage; and for any two or more of the data whose reuse signatures differ by less than said predetermined percentage, identifying a reference affinity among said two or more data*. However, Zhong teaches comparing reuse signature percentage differences in a histogram. See Fig. 4. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Zhong's percentile histogram with Ding's histogram in order to determine peaks where large portions of references occur, as suggested by Zhong (see paragraph 1 in section 3.2, page 8). Zhong does not expressly disclose using a predetermined value to identify reference affinity. However, Yakhini teaches the use of a predetermined value to identify reference affinity among data. See column 13 lines 21-23. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use Yakhini's determination of affinity with Zhong's histogram in order to provide an optimal partitioning of data as suggested by Yakhini (see column 2 lines 9-14).

In regard to claim 34, the above rejection of claim 18 is incorporated. All further limitations have been addressed in the above rejection of claim 17.

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14. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ding and Kaneko as applied to claim 35 above, and further in view of Zhong and Yakhini.

In regard to claim 37, the above rejection of claim 35 is incorporated. All further limitations have been addressed in the above rejection of claim 17.

### *Conclusion*

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to J. Derek Rutten whose telephone number is (571)272-3703. The examiner can normally be reached on M-F 7:00-3:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on (571)272-3695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would

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like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

jdr



TUAN DAM  
SUPERVISORY PATENT EXAMINER